Claims

What is claimed is:

1. A method for repeating wireless signals bidirectionally and synchronously, which is applied to the TDD wireless communication system comprising a base station and a terminal device, characterized in that said method comprises:

step A: obtaining synchronization information of said system from wireless signals emitted from said base station;

step B: generating reference control signals accurately synchronized with the base station according to the obtained system synchronization information and the system time slot configuration information;

step C: processing said reference control signals accurately synchronized with the base station respectively to generate a plurality of time sequential control signals to control the uplink RF amplification, the downlink RF amplification and the receiving and transmission respectively, thereby controlling the downlink channel to be closed when uplink channel is open and the uplink channel to be closed when the downlink channel is open, so as to repeat signals emitted from the uplink/downlink channel between said base station and terminal devices bidirecitonnally and synchronously.

2. A method as claimed in claim 1, characterized in that the generation of reference control signals accurately synchronized with the base station according to the system synchronization information described in step B comprises:

step B1: generating synchronization pulses and activating a timer when obtaining the system synchronization information;

step B2: the timer activated in step B1 beginning to time according to the system time slot configuraiont information and switching the uplink and downlink enable signals based on the timing of the timer, thereby generating reference control signals accurately synchronized with the base station.

3. A method as claimed in claim 1, characterized in that, between step B1 and

B2, said method further comprises:

obtaining the adjustable timing for synchronization from the base station, and calculating the lag timing between the synchronization pulses generated in step B1 and the synchronization time slot including the synchronization information corresponding to this pulse.

4. A method as claimed in claim 3, characterized in that said timer times according to said lag timing, the total time of uplink/ downlink time slots and the time of the guard time slots G_{T0}/G_{T1} in the time slot configuration, and allows the accurate synchronous reference control signals to switch between the uplink and downlink enable signals after the last transmission data bit in the uplink /downlink time slot.

5. A method as claimed in claim 4, characterized in that the initial timing of said timer is: the total time of the uplink time slot+the time of the guard time slot G_{T0}−(the lag timing−the time of the synchronization time slot), a downlink enable signal being generated after the initial timing is carried out; the timer begins to time a downlink enable signal: the time of the guard time slot G_{T1}+the total time of the downlink time slot, the uplink enable signal being generated after the timing is carried out; the timer begins to time an uplink enable signal: the time of the guard time slot G_{T0}+the total time of the uplink time slot, the downlink enable signal being generated again after the timing of the uplink enable signal is carried out; and the timer repeats the above operation to time the uplink and downlink enable signals, the uplink enable signals and downlink enable signals being generated repeatedly according to these timings, thereby generating said reference control signals accurately synchronized with the base station.

6. A method as claimed in claim 2, characterized in that, said method further comprises:

synchronizing said timer one time using said synchronization pulses after a predetermined period to eliminate the accumulated errors of the timer clock.

7. A method as claimed in claim 1, characterized in that said sequential

control signals descirbed in step C are obtained by logically converting and delaying said reference control signals accurately synchronized with the base station.

8. A method as claimed in claim 7, characterized in that said logical conversion and delay indicate concretely:

delaying the downlink RF amplification control signals, the uplink RF amplification control signals, and the receive and transmit control signals respectively, so that:

when switching from the downlink enable to the uplink enable, the downlink RF amplification control signal(PA_EN1) is firstly switched into an inactive state, then the receive and transmit control signal(SW) is switched to allow the uplink channel to be open, and finally the uplink RF amplification control signal (PA_EN2) is switched into an active state; and

when switching from the uplink enable to the downlink enable, the uplink RF amplification control signal (PA_EN2) is firstly switched into an inactive state, then the receive and transmit control signal (SW) is switched to allow the downlink channel to be open, and finally the downlink RF amplification control signal (PA_EN1) is switched into active state.

9. A method as claimed in claim 8, characterized in that said active state of the uplink and downlink RF amplification control signals are indicated by a high level, and said inactive state by a low level.

10. A method as claimed in claim 8 or 9, characterized in that, in step C,

said control closing the downlink channel when the uplink channel is open performs as follows:

firstly, the downlink RF amplification control signal (PA_EN1) switched into inactive state allows the downlink of power amplification to be close, then the uplink channel is opened and the downlink channel is closed by the receive and transmit control signal (SW), and finnaly the uplink RF amplification control signal (PA_EN2) switched into active state enables the uplink of the power

amplification; and

said control closing the uplink channel when the downlink channel is open performs as the following:

firstly, the uplink RF amplification control signal (PA_EN2) switched into inactive state allow the uplink of the power amplification to be closed, then the downlink channel is opened and the uplink channel is closed by the receive and transmit control signal (SW), and finnaly the downlink RF amplification control signal (PA_EN1) which is switched into active state enables the downlink of power amplification.

11. An apparatus for repeating wireless signals bidirectionally and synchronously, characterized in that,said apparatus comprises a receiving antenna for base station signals, a receiving antenna for terminal device signals, a frequency selection and bidirection RF amplification circuit, and a synchronization extraction and control device, wherein,

the synchronization extraction and control device receives wireless signals emitted from the base station by the receiving antenna for base station signals, generates sequential control signals by using these wireless signals and the system time slot configuration inforamtion, and transmits the sequential control signals to the frequency selection and bidirection RF amplification circuit; and

the frequency selection and bidirection RF amplification circuit receives wireless signals emitted from the base station by the receiving antenna for base station signals, opens the downlink channel while closes the uplink channel, amplifies and filters these wireless signals according to the sequential control signals transmitted from the synchronization extraction and control device, then repeats the amplified wireless signals to terminal devices by the receiving antenna for terminal devices signals; receives wireless signals emitted from terminal devices by the receiving antenna for terminal device signals, opens the uplink channel while closing the downlink channel, amplifies and filters these wireless signals according to the sequential control signals transmitted from the

synchronization extraction and control device, and then repeats the amplified wireless signals to the base station by the receiving antenna for base station signals.

12. An apparatus for repeating wireless signals bidirectionally and synchronously as claimed in claim 11, characterized in that said frequency selection and bidirection RF amplification circuit comprises:

a filter set for filtering wireless signals which are received and repeated by receive and transmit antennas and emitted from terminal devices and the base station so as to obtain RF signals in the desired band and eliminate interfering signals from out bands;

a receive and transmit switch set for controlling receiving and/or transmitting the obtained RF signals in the desired band;

a power amplification device for amplifying the obtained RF signals in the desired band to reach a power which is required when these signals are reveived and transmitted.

13. An apparatus as claimed in claim 11, characterized in that said frequency selection and bidirection RF amplification circuit comprises: a first filter, a second filter, a first receive and transmit switch, a second receive and transmit switch, a power amplification device for uplink signals, and a power amplification device for downlink signals, said first and second receive and transmit switch being used for opening the uplink channel and closing the downlink channel or for opening the downlink channel and closing the uplink channel under the control of the sequential control signals, the power amplification device for uplink signals and the power amplification device for downlink signals being in on state and in off state respectively under the control of the sequential control signals when the uplink channel is opened, and the power amplification device for uplink signals and the power amplification device for downlink signals being in off state and in on state respectively under the control of the sequential control signals when the downlink channel is opened, wherein,

for the uplink channel:

a wireless signal emitted from terminal devices and received by the receiving antenna for terminal device signals is filtered by the second filter, then transmitted to the power amplification device for downlink signals through the second receive and transmit switch and amplified, the amplified wireless signal is transmitted to the first filter through the first receive and transmit switch and filtered, next the amplified wireless signal after being filtered is transmitted from the first filter to the receiving antenna for base station signals and emitted to the base station by means of the receiving antenna for base station signals; and

for the downlink channel:

a wireless signal emitted from the base station and received by the receiving antenna for base station signals is filtered by the first filter, then transmitted to the power amplification device for uplink signals through the first receive and transmit switch and amplified; the amplified wireless signal is transmitted to the second filter through the sencond receive and transmit switch and filtered; the second filter transmits the amplified wireless signal after being filtered to terminal devices by means of the receiving antenna for terminal device signals.

14. An apparatus as claimed in claim 12 or 13, characterized in that said power amplification device comprises a power amplifier and a variable gain regulator for regulating the output signal level of the power amplifier to control the amplification factor of amplification devices.

15. An apparatus as claimed in claim 13, characterized in that said downlink power amplification device comprises:

a first to fourth power amplifier, a first converter, a second converter, a first SAW filter, and a first variable gain regulator, wherein, a signal emitted from the base station is transmitted to the input terminal of the first power amplifier through the first receive and transmit switch, then amplified by the first power amplifier, and next down-converted to IF signals by the first converter; after being amplified by the second amplifier, IF filtered in the first SAW filter, level-regulated by the

first variable gain regulator, amplified by the third amplifier, up-converted to RF signals by the second converter, and amplified by the fourth amplifier, the signal emitted from this base station reach a predetermined level and then transmitted through the second receive and transmit switch;

and said uplink power amplification device comprises:

a fifth to eighth power amplifier, a third converter, a fourth converter, a second SAW filter, and a second variable gain regulator, wherein a signal emitted from terminal devices is tranmitted to the input terminal of the fifth power amplifier through the second receive and transmit switch, then amplified by this power amplifier, and next down-converted to IF signals by the third converter; after being amplified by the sixth amplifier, IF filtered in the second SAW filter, level-regulated by the second variable gain regulator, amplified by the seventh amplifier, up-converted to RF signals by the fourth converter, and amplified by the eighth amplifier, the signal emitted from the terminal devices reaches a predetermined level and then transmitted through the first receive and transmit switch.

16. An apparatus as claimed in claim 14 or 15, characterized in that said variable gain regulator can be an adjustable attenuator or a variable gain amplifer.

17. An apparatus as claimed in claim 11, characterized in that said synchronization extraction and control device comprises:

a wireless transceiver for receiving wireless signals emitted from the base station and emitting wireless signals to the base station;

a synchronization extraction device for extracting the system synchronization information from wireless signals emitted from the base station; and

a sequential control device for generating control sequence corresponding to signals emitted from the base station and terminal devices based on the system synchronization information to control the frequency selection and bidirection RF amplification circuit.

18. An apparatus as claimed in claim 17, characterized in that the sequential

control device is further used to monitor the frequency selection and bidirection RF amplification circuit and emit malfunction monitor signals to the base station by means of the wirelesss transceiver.

19. An apparatus as claimed in claim 11, characterized in that said receiving antenna for base station signals comprises:

a first receiving antenna for base station signals, for receiving wireless signals emitted from the base station, transmitting these wireless signals to the frequency selection and bidirection RF amplification circuit and repeating wireless signals emitted from terminal devices to the base station;

a second receiving antenna for base station signals, for receiving wireless signals emitted from the base station and transmitting these wireless signals to the synchronization extraction and control device.

20. An apparatus as claimed in claim 11, characterized in that said receiving antenna for base station signals comprises:

a third receiving antenna for base station signals for receiving wireless signals emitted from the base station, and

a coupler by which wireless signals are sent to the frequency selection and bidirection RF amplification circuit and the synchronization extraction and control device respectively.

21. An apparatus as claimed in claim 11, characterized in that the receiving antenna for base station signals and the receiving antenna for terminal devices signals form a receiving and transmitting antenna set.